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**A Sealable Food Container With Improved Lidding and Stacking Features**

A SEALABLE FOOD CONTAINER WITH IMPROVED LIDDING AND  
STACKING FEATURES

5    Cross-Reference to Related Applications

          This application is a continuation-in-part of United States Patent Application No. 09/921,264, entitled "Disposable Serving Plate With Sidewall-Engaged Sealing Cover", filed August 2, 2001 (Attorney Docket No. 2242). United States Patent Application No. 09/921,264 was based on Provisional Application No. 60/223,209, filed August 4, 2000 of the same title. This application also incorporates material in United States Provisional Patent Application No. 60/305,225, entitled "Crush-Resistant Disposable Lid", filed July 13, 2001 (Attorney Docket No. 2366). The priorities of the foregoing applications are hereby claimed.

15   Technical Field

          The present invention relates generally to food containers. In a preferred embodiment, there is provided a serving plate with a sidewall-engaged sealing cover so as to provide for storage and transport as well as serving of the contents.

20   Background

          Sealable food containers are known in the art. Illustrative in this respect is United States Patent No. 5,377,860 to *Littlejohn et al.* In the '860 patent there is disclosed a container having a base with an upwardly projecting sidewall integrally formed with a brim. The brim of the base is formed with a number of integral cooperating features including a reinforcing hoop and sealing surfaces. A lid is configured to fit the base and includes a dome as well as a lid brim configured to cooperate with the brim of the base. Thus, in accordance with the '860 patent there is provided a food container with a flexible brim seal between the lid and base which is provided by way of the respective brim designs.

The present invention is likewise directed to a sealable food container, wherein the base is preferably in the form of a platter, bowl or plate provided with a sidewall and an arcuate flange portion as well as a sealing lid which engages the sidewall of the base. As such, the present invention provides improved graspability and utility as a food service article as opposed to being designed primarily for storage and reheating. Preferred embodiments include a novel sidewall sealing system as well as stacking features as described hereafter.

### Summary of Invention

There is provided in a first aspect of the present invention a sealable food container including a base serving member having a generally planar base central portion, a base sidewall extending generally upwardly and outwardly therefrom and a base outer flange portion extending outwardly from the base sidewall. The base sidewall defines a sealing portion with (i) an undercut annular base sealing surface, (ii) a base stop ridge adjacent the upper edge of the annular base sealing surface, as well as (iii) a laterally extending retaining shelf adjacent the lower edge of the annular base sealing surface.

A sealing lid is provided with a dome portion and a flexible lid sidewall extending downwardly from the dome portion as well as a lid flange portion extending outwardly with respect to the downwardly extending sidewall of the lid. The lid flange portion defines a sealing portion with an annular lid sealing surface extending upwardly with respect to the downwardly extending sidewall of the sealing lid. The sealing portion of the lid also defines a lid stop ridge, typically at the upper edge of the annular lid sealing surface. The base serving member and the sealing lid are configured such that when the sealing lid is forced downwardly on the base serving member the sealing lid is secured to the base serving member by cooperation of the base stop ridge of the base serving member and the lid stop ridge of the sealing

lid. Moreover, the laterally extending retaining shelf in the base sidewall serves to position the lid with respect to the base.

Generally, the laterally extending retaining shelf of the base serving member  
5 extends outwardly over a base sidewall shelf length of at least about 0.5% of the  
characteristic diameter of the base serving member. In most cases, the sidewall shelf  
length of the base serving member is at least about 1% of the characteristic diameter  
of the base serving member and is frequently at least about 1.5% of the characteristic  
10 diameter of the base serving member. The sealing lid is preferably provided with a  
laterally extending lid shelf extending between the flexible sidewall of the sealing lid  
and the annular sealing surface of the lid wherein the lid shelf extends outwardly over  
a lid shelf radial span and is adapted to cooperate with the retaining shelf of the base  
serving member to position the sealing lid with respect thereto. Typically, the lid  
15 shelf radial span is at least about 25% of the base sidewall retaining shelf length and  
in preferred embodiments the lid shelf radial span is at least about 50% of the base  
sidewall retaining shelf length. In many embodiments, the lid shelf radial span is at  
least about 75% of the base sidewall retaining shelf length.

In a preferred embodiment, the undercut annular sealing surface of the base  
20 serving member is a frustal sealing surface extending upwardly and outwardly with  
respect to the substantially planar central portion of the base serving member and the  
annular sealing surface of the lid is a frustal sealing surface extending upwardly and  
outwardly with respect to the downwardly extending sidewall of the sealing lid. The  
base stop ridge is typically located adjacent the upper edge of the sealing surface of  
25 the sidewall of the base and the lid stop ridge typically is located adjacent the upper  
edge of the sealing surface of the sealing lid. The sealing lid is preferably configured  
and dimensioned so as to outwardly flexibly urge the frustal sealing surface of the lid  
into surface to surface contact with the frustal sealing surface of the base serving  
member when a base serving member and the sealing lid are secured to one another.

In preferred embodiments, both the outer flange of the base and the outer flange of the lid are arcuate outer flanges. So also, the flexible sidewall of the sealing lid is preferably a fluted sidewall. Generally, the dome portion of the sealing lid has a generally planar upper surface portion and a downwardly extending sidewall  
5 preferably provided with a plurality of outwardly convex flutes formed in the sidewall, wherein the flutes have a characteristic cylindrical diameter or a plurality of characteristic diameters and wherein the lid includes about 3 or fewer flutes per inch of engagement perimeter.

10 As used herein, the term "engagement perimeter" refers to the circumferential length at the lower edge of the base stop ridge around the base, which corresponds roughly to the circumferential length at the upper edge of the annular sealing surface of the lid as well.

15 Outwardly convex flutes may be circumferentially spaced apart from one another along the sidewall optionally by relatively flat sidewall segments of the lid. The flutes may be spaced apart by circumferential distances varying in the range of from about 0.05 inches to about 0.25 inches in some embodiments.

20 Preferably, the convex flutes project upwardly with respect to the generally planar upper surface portion of the dome and define a retaining ridge upper profile which is raised with respect to the planar part of the dome and the base member is provided with a stacking annular recess at the lower portion of the sidewall of the base adapted to engage the raised retaining ridge profile. The annular recess is a  
25 stacking feature adapted to engage the raised retaining ridge profile of the sealing lid in order to render a plurality of sealable food containers configured in accordance with the present invention securely stackable with one another. Preferably, the stacking recess has an arcuate profile for ease of forming and which also will not result in a sharp corner in the interior of the base which may interfere with the use of

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the base as a food service article. That is, a sharp interior corner can interfere with the use of an eating utensil such as a fork or spoon when the base is a plate or bowl. The retaining ridge likewise has an arcuate inner profile in preferred embodiments.

5 Typically, the retaining ridge profile on the upper surface of the sealing lid comprises a plurality of spaced flute profiles extending inwardly from the outer edge of the flexible sidewall of the lid and extending upwardly with respect to the planar portion of the dome as shown, for example in the appended figures. Those profiles may be arcuate with a top generally flat portion if so desired and may likewise be  
10 uniform or include a plurality of different size flutes with different characteristic flute diameters and heights above the dome if so desired. The sealing lid may include from about 1.5 to about 2.5 flutes per inch of engagement perimeter or more typically from about 2 to about 2.5 flutes per inch of engagement perimeter are provided. The flutes may have any suitable characteristic cylindrical diameter which is typically from  
15 about 0.2 inches to about 0.80 inches. The characteristic cylindrical diameter of the flutes is preferably at least about 0.75% of the length of engagement perimeter of the sealing lid. Typically the characteristic cylindrical diameter of convex flutes is in the range of from about 1% to about 2.5% of the length of the engagement perimeter. As noted above, the flute profiles extend upwardly as well as inwardly with respect to  
20 the generally planar central portion of the lid's dome. An inward extension length of the flutes from the outer periphery of the lid adjacent the generally planar upper surface portion of the dome is usually at least about 0.2 inches and typically at least about 0.3 inches. That extension may be flat or arcuate. The upper inward extension length of the flutes above the generally planar upper surface portion of the dome from  
25 their outer periphery is usually from about 1% to about 3% of the length of the engagement perimeter of the sealing lid. The flutes may have a flute height above the generally planar upper surface portion of the dome of greater than about 0.07 inches and typically from about 0.07 inches to about 0.15 inches. The dome portion and sidewall of the sealing lid is provided in a preferred embodiment with a plurality of

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6

generally raised flat portions between the convex flutes having generally a circumferential span of about 0.05 to about 0.2 inches. These flat portions have a height above the generally planar upper surface portion of the dome of from about 0.01 inches to about 0.1 inches.

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The sealing lid is preferably provided with a laterally extending lid shelf with an optionally sinuous edge extending between the flexible sidewall of the sealing lid and the annular sealing surface of the lid wherein the lid shelf extends outwardly over a radial span and is adapted to cooperate with the retaining shelf of the base serving member to position the serving lid with respect thereto. The laterally extending retaining shelf of the base serving member preferably extends over a distance of at least about 25% of the characteristic diameter of the convex flutes of the sealing lid.

In typical embodiments, the base serving member and the sealing lid are formed from sheet thermoplastic material. Such material may be in the form of a continuous roll or web or precut into individual sheets if so desired. The base serving member and sealing lid are thermoformed, thermoformed by the application of vacuum or thermoformed by a combination of vacuum and pressure.

The thermoplastic material from which the base or lid is formed may include a foamed or solid polymeric material selected from the group consisting of polyesters, polystyrenes, polypropylenes, polyethylenes and mixtures thereof.

The base member is perhaps most preferably thermoformed from a mineral filled, polypropylene sheet. The serving base member may have a wall thickness of from about 10 to about 80 mils and consist essentially of from about 40 to about 90% by weight of a polypropylene polymer, from about 10 to about 60% by weight of a mineral filler, from about 1 to about 15% by weight polyethylene, up to about 5 weight percent titanium dioxide and optionally including a basic organic or inorganic

compound comprising the reaction product of an alkali metal or alkaline earth metal with carbonates, phosphates, carboxylic acids as well as alkali metal and alkaline earth element oxides, hydroxides, or silicates and basic metal oxides, including mixtures of silicon dioxide with one or more of the following oxides: magnesium oxide, calcium oxide, barium oxide, and mixtures thereof. The base serving member may typically have a wall caliper from about 10 to about 50 mils (thousandths of an inch), whereas from about 12 to about 25 mils is typical.

The sealing lid is perhaps most preferably formed of a styrene polymer composition. That composition may be a styrene butadiene copolymer, or simply be oriented polystyrene. The sealing lid typically has a wall caliper of from about 2 to about 15 mils and may have a caliper of from about 5 to about 13 mils.

In another aspect of the invention there is provided a base serving member having a generally planar base central portion, a base sidewall extending generally upwardly and outwardly therefrom and a base outer flange portion extending outwardly from the sidewall. The base serving member includes a base sealing portion outwardly disposed with respect to the generally planar central portion as well as an annular stacking sidewall recess at the lower part of the sidewall. A sealing lid configured to cooperate with the base serving member includes a dome portion having a generally planar upper central surface and a flexible lid sidewall extending downwardly from the dome portion. The sealing lid defines an annular sealing portion and is preferably provided with a plurality of outwardly convex flutes in the flexible lid sidewall projecting upwardly with respect to the generally planar upper central surface of the dome portion of the sealing lid to define a retaining ridge profile at the outer edge of the central portion of the dome. The base serving member and the sealing lid are configured such that when the sealing lid is forced downwardly on the base serving member, the annular lid sealing portion of the sealing lid cooperates with the base sealing portion of the serving member to secure the sealing lid to the



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## 10 Brief Description of Drawings

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**Figure 3** is a schematic detail along line 3-3 of **Figure 1** showing the geometry of the inventive sealing lid;

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**Figure 5** is a schematic view along line 5-5 of **Figure 1** showing the profile of the flat portion of the sealing lid between the flutes in the sidewall of the lid of the containers:

**Figure 6** is a schematic diagram comparing the profile of the flat portions between flutes and the outwardly convex flutes about the periphery of the sealing lid of the inventive container;

5        **Figure 7** is an enlarged schematic detail illustrating the cooperation of the base serving member and the sealing lid to secure the inventive lid and base to one another and provide a sealed interior; and preferably, a substantially liquid proof seal; and

10        **Figure 8** is a schematic diagram illustrating the cooperation of the inventive stacking features of the present invention to provide a secure stack of containers.

#### Detailed Description

20        The present invention is described in detail below for purposes of exemplification and illustration, only. Modification of specific embodiments or variations thereof within the spirit and scope of the appended claims will be readily apparent to those of skill in the art. In general, the present invention is directed to a sealable food container and preferably a disposable food container including a base such as a platter or a plate having a sidewall extending upwardly and outwardly from its central portion and a sealing lid with a sealing surface configured to engage the sidewall in sealing contact. The seal is preferably continuous and substantially liquid-proof, whereas the materials forming the plate or platter and the sealing cover are resilient and flexible. These materials are also preferably selected so as to be suitable for heating or re-heating the contained food, for example, by way of a conventional or microwave oven or by heat lamps and so forth.

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The containers of the invention are made by any suitable technique, typically, techniques employed for forming plastics. The products may thus be made from thermoplastic sheet which has been pre-cut or in the form of a continuous web or roll

formed, thermoformed, thermoformed by the application of vacuum or thermoformed by a combination of vacuum and pressure into the products of the invention.

Alternatively, the inventive containers may be made from a plastic material by injection molding, injection blow molding, compression molding, injection stretch  
5 molding, composite injection molding and so forth. Thermoforming from plastic sheet is particularly preferred.

In the simplest form, thermoforming is the draping of a softened sheet over a shaped mold. In the more advanced form, thermoforming is the automatic high speed  
10 positioning of a sheet having an accurately controlled temperature into a pneumatically actuated forming station whereby the article's shape is defined by the mold, followed by trimming and regrind collection as is well known in the art. Still other alternative arrangements include the use of drape, vacuum, pressure, free blowing, matched die, billow drape, vacuum snap-back, billow vacuum, plug assist  
15 vacuum, reverse draw with plug assist, pressure bubble immersion, trapped sheet, slip, diaphragm, twin-sheet cut sheet, twin-sheet roll-fed forming or any suitable combinations of the above. Details are provided in J.L. Throne's book, *Thermoforming*, published in 1987 by Coulthard. Pages 21 through 29 of that book are incorporated herein by reference. Suitable alternate arrangements also include a  
20 pillow forming technique which creates a positive air pressure between two heat softened sheets to inflate them against a clamped male/female mold system to produce a hollow product. Metal molds are etched with patterns ranging from fine to coarse in order to simulate a natural or grain-like texturized look. Suitable formed articles are trimmed in line with a cutting die and regrind is optionally reused since  
25 the material is thermoplastic in nature. Other arrangements for productivity enhancements include the simultaneous forming of multiple articles with multiple dies in order to maximize throughput and minimize scrap.

A particularly preferred material for a plate or platter is mica-filled polypropylene, optionally provided with calcium carbonate, polyethylene and titanium dioxide in suitable amounts as hereinafter described. The sealing lid or cover may be opaque or transparent and is most preferably made of a transparent  
5 styrene polymer composition. Typically, the lid is oriented or rubberized to give it sufficient rigidity and flexibility to provide a good seal. As will be appreciated by one of skill in the art, suitable polymeric materials for the disposable plate and cover are readily available. Mineral filled polypropylene, especially mica filled polypropylene is, for example, suitable for the base as noted above. Other suitable  
10 flexible and resilient materials include other polyolefins such as polyethylenes, polypropylenes and mixtures and copolymers thereof, polyesters, polyamides, polyacrylates, polystyrenes, polysulfones, polyether ketones, polycarbonates, acrylics, polyphenylene sulfides, acetals, cellulose, polyetherimides, polyphenylene ethers/oxides, styrene maleic anhydride copolymers, styrene acrylonitrile copolymers,  
15 polyvinylchlorides, and engineered resin derivatives thereof. These materials may be filled or unfilled, solid (continuous) or foamed.

A platter, bowl or plate of the food container of the present invention may be produced utilizing polymeric compositions filled with conventional inorganic fillers  
20 such as talc, mica, wollastonite and the like, wherein the polymer component is, for example, a polyester, a polystyrene homopolymer or copolymer, a polyolefin or one or more of the polymers noted above. While any suitable polymer may be used, polypropylene polymers which are suitable for the plate, bowl or platter are preferably selected from the group consisting of isotactic polypropylene, and  
25 copolymers of propylene and ethylene wherein the ethylene moiety is less than about 10% of the units making up the polymer, and mixtures thereof. Generally, such polymers have a melt flow index from about 0.3 to about 4, but most preferably the polymer is isotactic polypropylene with a melt-flow index of about 1.5. In some preferred embodiments, the melt-compounded composition from which the articles

are made may include polypropylene and optionally further includes a polyethylene component and titanium dioxide. A polyethylene polymer or component may be any suitable polyethylene such as HDPE, LDPE, MDPE, LLDPE or mixtures thereof and may be melt-blended with polypropylene if so desired.

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The various polyethylene polymers referred to herein are described at length in the *Encyclopedia of Polymer Science & Engineering* (2d Ed.), Vol. 6; pp: 383-522, Wiley 1986; the disclosure of which is incorporated herein by reference. HDPE refers to high density polyethylene which is substantially linear and has a density of generally greater than 0.94 up to about 0.97 g/cc. LDPE refers to low density polyethylene which is characterized by relatively long chain branching and a density of about 0.912 to about 0.925 g/cc. LLDPE or linear low density polyethylene is characterized by short chain branching and a density of from about 0.92 to about 0.94 g/cc. Finally, intermediate density polyethylene (MDPE) is characterized by relatively low branching and a density of from about 0.925 to about 0.94 g/cc.

Typically, in filled plastics useful for making the plate or container base of the food container the primary mineral filler is mica, talc, kaolin, bentonite, wollastonite, milled glass fiber, glass beads (solid or hollow), silica, or silicon carbide whiskers or mixtures thereof. We have discovered that polypropylene may be melt-compounded with acidic-type minerals such as mica, as well as inorganic materials and/or basic materials such as calcium carbonate. Other fillers include talc, barium sulfate, calcium sulfate, magnesium sulfate, clays, glass, dolomite, alumina, ceramics, calcium carbonate, silica, pigments such as titanium dioxide based pigments and so on. Many of these materials are enumerated in the *Encyclopedia of Materials Science and Engineering*, Vol. # 3, pp. 1745 – 1759, MIT Press, Cambridge, MA (1986), the disclosure of which is incorporated herein by reference. Combinations of fillers are preferred in some embodiments.

Mineral fillers are sometimes referred to by their chemical names. Kaolins, for example, are hydrous aluminosilicates, while feldspar is an anhydrous aluminosilicate. Bentonite is usually an aluminum silicate clay and talc is hydrated magnesium silicate. Glass, or fillers based on silicon dioxide may be natural or synthetic silicas. Wollastonite is a calcium metasilicate whereas mica is a potassium aluminosilicate. Clays may be employed as a primary filler; the two most common of which are kaolin and bentonite. Kaolin refers generally to minerals including kaolinite which is a hydrated aluminum silicate ( $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ ) and is the major clay mineral component in the rock kaolin. Kaolin is also a group name for the minerals kaolinite, macrite, dickite and halloysite. Bentonite refers to hydrated sodium, calcium, iron, magnesium, and aluminum silicates known as montmorillonites which are also sometimes referred to as smectites.

Fillers commonly include: barium salt; barium ferrite; barium sulfate; carbon/coke powder; calcium fluoride; calcium sulfate; carbon black; calcium carbonate; ceramic powder; chopped glass; clay; continuous glass; glass bead; glass fiber; glass fabric; glass flake; glass mat; graphite powder; glass sphere; glass tape; milled glass; mica; molybdenum disulfide; silica; short glass; talc; whisker. Particulate fillers, besides mica, commonly include: glass; calcium carbonate; alumina; beryllium oxide; magnesium carbonate; titanium dioxide; zinc oxide; zirconia; hydrated alumina; antimony oxide; silica; silicates; barium ferrite; barium sulphate; molybdenum disulfide; silicon carbide; potassium titanate; clays. Fibrous fillers are commonly: whiskers; glass; mineral wool; calcium sulphate; potassium titanate; boron; alumina; sodium aluminum hydroxy carbonate.

As noted above, a mica-filled polypropylene polymer composition is particularly preferred for forming the base or plate portion of the container.

The dome portion of the present invention may be formed of any of the materials described above, and is perhaps most preferably formed from an oriented or rubberized polystyrene composition, optically transparent materials being preferred in many cases. The lid or dome may be thermoformed from biaxially oriented  
5 polystyrene sheet (OPS) or can include polystyrene and a blended rubber component or may be a styrene/rubber copolymer such as K resin. K resin is a copolymer of styrene and butadiene and is available from Phillips Petroleum, Bartlesville, Oklahoma. Preferred grades included from about 2 to about 40 wt.% butadiene. Alternatively or in addition to diene comonomer, the styrene compositions may  
10 contain one or more of the rubbery polymers discussed below.

So-called core-shell polymers built up from a rubber-like core on which one or more shells have been grafted may be used. The core usually consists substantially of an acrylate rubber or a butadiene rubber. One or more shells have been grafted on  
15 the core. Usually these shells are built up for the greater part from a vinylaromatic compound and/or a vinylcyanide and/or an alkyl(meth)acrylate and/or (meth)acrylic acid. The core and/or the shell(s) often comprise multi-functional compounds which may act as a cross-linking agent and/or as a grafting agent. These polymers are usually prepared in several stages.

20 Olefin-containing copolymers such as olefin acrylates and olefin diene terpolymers can also be used as rubbery modifiers in the present compositions. An example of an olefin acrylate copolymer modifier is ethylene ethylacrylate copolymer available from Union Carbide as DPD-6169. Other higher olefin monomers can be  
25 employed as copolymers with alkyl acrylates, for example, propylene and n-butyl acrylate. The olefin diene terpolymers are well known in the art and generally fall into the EPDM (ethylene propylene diene) family of terpolymers. They are commercially available such as, for example, EPSYN 704 from Copolymer Rubber

Company. They are more fully described in United States Patent No. 4,559,388, incorporated by reference herein.

Various rubber polymers and copolymers as such can also be employed as  
5 modifiers. Examples of such rubbery polymers are polybutadiene, polyisoprene, and various other polymers or copolymers having a rubbery dienic monomer.

Styrene-containing rubbery polymers are also suitable modifiers. Examples of  
such polymers are acrylonitrile-butadiene-styrene, styrene-acrylonitrile, acrylonitrile-  
10 butadiene-alpha-methylstyrene, styrene-butadiene, styrene butadiene styrene, diethylene butadiene styrene, methacrylate-butadiene-styrene, high rubber graft ABS, and other high impact styrene-containing polymers such as, for example, high impact polystyrene. Other known impact modifiers include various elastomeric materials  
such as organic silicone rubbers, elastomeric fluorohydrocarbons, elastomeric  
15 polyesters, the random block polysiloxane-polycarbonate copolymers, and the like. The preferred organopolysiloxane-polycarbonate block copolymers are the dimethylsiloxane-polycarbonate block copolymers in some embodiments.

The sealable containers according to the present invention may have any  
20 particular size and shape as desired so long as the relative base and lid features are present. More specifically, square or rectangular with rounded corners, triangular, oval, multi-sided, polyhedral, and similar shapes may be made having the profile described above including plates, bowls, platters, and common lidding features such  
as 6-1/16-inch and 12 oz., 7-5/16-inch and 20 oz. plates and bowls. In various  
25 embodiments of the present invention the container may be 6-1/16-inch, 7-5/16-inch, 9-inch, 10-1/4-inch and 11-inch plates and so forth. The container may include a compartmented base in the form of a plate of the class described in co-pending United States Patent Application Serial No. 09/354,706, filed July 16, 1999, entitled



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16

"Compartmented Disposable Plate With Asymmetric Rib Geometry", (Attorney Docket No. 2195; FJ-99-10), now United States Patent No. \_\_\_\_\_, the disclosure of which is hereby incorporated by reference.

5           Throughout this specification and claims, the term "dome" and its derivatives are used in the broad sense of a vault, ceiling, cover or roof having an inner surface which is generally concave regardless of whether the inner surface is hemispherical, polyhedral or another compound shape.

10           Referring to the various Figures there is shown a sealable food container 10 including a plate 12 having a generally planar central portion 14, a plate sidewall 16 extending generally upwardly and outwardly therefrom and a plate outer flange portion 18 extending outwardly from the sidewall. The planar central portion or bottom 14 of the plate may be provided with a slight crown if so desired as is known  
15 in the art to prevent rocking when the container is placed on a flat surface. The plate is generally circular with a characteristic diameter, D which may be, for example, about 10 ¼ inches and have a circumference around its sealing area of between 25 and 30 inches or so; that is, the diameter of the stop ridge about its lower edge in the sidewall may be about 8 5/8 inches for a plate with a characteristic diameter of 10 ¼  
20 inches. The characteristic diameter of a container base used in connection with the present invention is the diameter across the outermost portion of the article for a generally circular article such as a plate. For other shapes, an average diameter may be used.

          Sidewall 16 defines a sealing portion 20 with an undercut annular sealing surface  
25 22 disposed between the substantially planar central portion 14 of plate 12 and the plate outer flange portion 18. Sidewall sealing portion 20 defines a base stop ridge 24 at the upper edge 26 of the undercut annular sealing surface 22 of the sidewall. There is further defined by the sidewall a laterally extending retaining shelf 28 adjacent to undercut annular sealing surface 22. Shelf 28 is generally horizontal (parallel to

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17

planar portion 14) and located adjacent lower edge 29 of annular plate sealing surface 22 as shown. Shelf 28 has a shelf length 31 over the generally horizontal span between edge 29 of surface 22 and an inner edge 27 of shelf 28.

Container 10 also includes a sealing lid 30 provided with a lid dome portion 32, a flexible lid sidewall 34 extending downwardly from dome portion 32. Both the flat portion of sidewall 34 and fluted portion of sidewall 34 are shown in Figure 6. The lid also has a lid flange portion 36 extending outwardly with respect to the downwardly extending lid sidewall. The lid flange portion includes at its inner periphery 38 a lid sealing portion 40. Lid sealing portion 40 defines a frustal sealing surface 42 extending upwardly and outwardly with respect to the downwardly extending sidewall of the sealing lid. Lid sealing portion 40 also defines a lid stop ridge 44, generally adjacent an upper edge 45 of surface 42. The plate and the sealing lid are configured such that when the sealing lid is forced downwardly on plate 12 sealing lid 30 is secured to the base serving member by cooperation of base stop ridge 24 and lid stop ridge 44.

Laterally extending retaining shelf 28 of plate 12 extends outwardly over a base shelf length 31 which is generally at least about 0.5% of the characteristic diameter D of plate 12. The characteristic diameter of the container is taken as the diameter, for example, of the base serving member in the case of a round plate as shown. With respect to other shapes that may be employed in accordance with the present invention, the characteristic diameter of the base serving member such as a plate or platter is taken as the average dimension across the base, for example, for a rectangular or polygonal shape, one simply would take a mean span across the article from one outer edge to its opposite outer edge across the middle of the article.

Referring in particular to Figures 3 through 5-7, the sealing lid is preferably provided with a laterally extending lid shelf 50 extending between flexible sidewall 34 of the sealing lid and the annular sealing surface 42 of lid 30. Lid shelf 50 extends

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18

outwardly over a lid shelf radial span 52 and is adapted to cooperate with the retaining shelf of plate 12 to position the sealing lid with respect to the base. It should be noted as used herein, the term "lid shelf radial span" refers to maximum span 52 from an inner edge 54 of the shelf to an outer edge 55 of lid shelf 50 such that in the case of a lid stop shelf that has a fluted or scalloped inner edge, the lid stop shelf radial span 52 is the maximum distance between inner edge 54 of the lid stop shelf and the upwardly and outwardly extending annular sealing surface 42 of sealing portion 40, as is shown at 56, for example. As noted above, the length of the lid shelf radial span is typically at least about 25% of base sidewall shelf length 31. Preferably the lid shelf radial span is greater than that.

In preferred embodiments, undercut sealing surface 22 of plate 12 is a frustal sealing surface extending upwardly and outwardly with respect to substantially planar central portion 14 of plate 12. Annular sealing portion 40 of sealing lid 30 also preferably includes a frustal configuration of sealing surface 42 extending upwardly and outwardly with respect to the downwardly extending sidewall of sealing lid 30.

Preferably base stop ridge 24 is located adjacent the upper edge of sealing surface 22 of sidewall 16 of plate 12; whereas lid stop ridge 44 is located adjacent the upper edge of sealing surface 42 of the lid. The lid is dimensioned so as to outwardly flexibly urge its frustal sealing surface 42 into surface to surface contact with frustal sealing surface 22 of plate 12 (also in a frustal configuration) when plate and sealing lid 30 are secured to one another.

Both the base serving member, typically a plate, and sealing lid may be provided with an arcuate outer flange. Outer arcuate flange 62 of plate 12 is generally arcuate in shape typically having a radius of curvature which is more or less constant. On the other hand, arcuate outer flange 64 of sealing lid 30 may have a

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19

plurality of ridges such as ridges 66 and 68 in its profile if so desired. In any case, sealing lid outer flange 64 is generally configured to overlay arcuate outer flange 62 of the plate as shown particularly in Figures 7 and 8.

5       Flexible sidewall 34 of sealing lid 30 is provided with a plurality of outwardly convex flutes 76 formed in the sidewall. Typically lid 30 includes about 3 or fewer flutes per inch of engagement perimeter, that is the circumferential length about the lower edge of base stop ridge 24 which is also approximately the circumferential distance about upper edge 45 of annular surface 42.

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As shown in Figure 3, flutes 76 have a characteristic cylindrical diameter,  $d$ , which is twice the radius of curvature,  $r$ , of the inner surface of the sidewall. As noted above this diameter is typically less than about 0.75 inches.

15       As will be appreciated from the Figures the outwardly convex flutes are typically circumferentially spaced apart from one another. The outwardly convex flutes are spaced apart a distance 78 (Figure 3) generally from about 0.05 to about 0.25 inches about the periphery of the lid. So also, the convex flutes project upwardly with respect to generally planar upper surface portion 80 of dome 32 of the sealing lid and define a generally upwardly convex and generally inwardly retaining ridge upper profile 82 as can be seen in the various Figures.

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Plate 12 is provided with an annular sidewall stacking recess 84 adjacent generally planar bottom portion 14 at the lower portion of sidewall 16. Recess 84 is adapted to engage generally convex retaining ridge profile 82 of the sealing lid in order to render a plurality of sealable food containers securely stackable with one another as is seen best in Figure 8.

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Typically the upwardly convex retaining ridge profile adjacent the upper, generally planar portion 80 of the sealing lid comprises a plurality of spaced arcuate flute profiles 76 extending inwardly from the outer periphery of the container. The inward extension length 88 (Figures 4, 6) of the flutes inwardly adjacent planar portion 80 of dome 32 may be of any suitable length; but typically at least about 0.2 and preferably at least about 0.3 inches in preferred embodiments.

The flutes may have a flute height 90 above generally planar upper surface 85 of dome 32 of greater than about 0.075 inches. In the embodiments shown, there are provided a plurality of flat portions 92 between the upwardly extending flutes 76 having a flat portion height 94 of generally greater than about 0.01 inches. The relative profiles of the flutes and flat portions there between are perhaps best appreciated by reference to Figures 4 through 6.

It should be appreciated by reference to Figure 3, that lid shelf 50 of lid 30 is typically a fluted lid shelf. Radial span 52 is indicated on Figure 3 as noted above.

Thus, in accordance with the invention there is provided an improved container provided with a relatively wide, preferably substantially horizontal shelf in the base member in the interior thereof defined on the sidewall and a cooperating relatively wide shelf in a matching lid. Moreover, the lid is provided with relatively wide, spaced flutes around the periphery of the center portion of the lid making it easier to force the lid into engagement with the horizontal ledge in the sidewall of the plate without deforming or damaging the lid but also making it possible to stack numerous lid/plate combinations. The upward projection of the sidewall flutes above the center flat portion of the lid is a convenient feature which helps stacking. So also, the matching contour or recess cut into the bottom of the plate which engages (peripherally with a slight clearance) with the flutes defining the periphery of the lid makes it easier to stack and makes the stacks more secure with the lidded plates on top

of one another. As will be appreciated from inspection of the appended drawings the radial span of the shelf of the lid may be essentially the same width as the ledge incorporated into the container base making it difficult inadvertently to force a matching lid past the ledge in the sidewall of the plate. The horizontal width of the retaining ledge around the interior of the wall may be, for example, approximately 155 thousandths of an inch.

The improved structure of the lid includes generally a reduced number of flutes, wherein the flutes are both deeper radially and have reinforcing domes extending over the center planar portion of the top of the lid and includes flats between the flutes of the lids which are also slightly raised above the center plane of the center portion on top of the lid. This improvement provides further rigidity to the lid which makes it easier to place and engage the container.

The lid is secured to the container by loosely placing the lid on the plate while the plate is resting on a flat surface, forcing the bottom of the ridges on one side of the lid into engagement with the horizontal ledge of the plate with one hand and then while holding the lid down use the other hand to seat the other side of the lid against the opposite portion of the horizontal ledge in the plate. Alternatively, one portion of the lid may be forced into engagement with the horizontal ledge in the plate using the heel of both hands while the opposite portion of the lid may be forced into engagement with the horizontal ledge on the opposite side of the plate using the fingertips. Preferably, the lid and base are configured such that the seal therebetween is generally liquid proof.

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While the invention has been described in detail, various modifications to the specific embodiment illustrated will be readily apparent to those of skill in the art. For example, one could produce a container with additional features such as

additional ridges and so forth. Such modifications are within the spirit and scope of the present invention defined in the appended claims.